STUDIES ON SOIL MYCOFLORA OF WADI BIR-EL-AIN, EASTERN DESERT, EGYPT

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SUMMARY. – 167 species in addition to 10 varieties which belong to 45 genera were isolated from 100 soil samples collected from Wadi Bir-El-Ain on glucose- (39 genera and 135 species + 9 varieties), cellulose- (37 genera and 113 species + 6 varieties), 40 % sucrose- (38 genera and 116 species + 6 varieties) and 5 % sodium chloride- Czapek's agar (27 genera and 99 species + 7 varieties).

On glucose and cellulose agar three species were isolated in high frequency and these were *Aspergillus niger, A. fumigatus* and *A. terreus* which occurred in 58-92 % of the samples constituting 4.44 - 19.66 % of total fungi.

On 40 % sucrose- and 5 % sodium chloride- agar, the most frequent species were *Aspergillus niger, A. fumigatus, A. terreus, A. glaucus* group (represented by *A. chevalieri, A. amstelodami, A. ruber, A. athecius* and *A. montevidensis*) and *Penicillium chrysogenum*. The results of these two media would show that the majority of the Wadi soil fungi are osmophilic (osmotolerant) and halophilic (or halotolerant).

Comparison between the present results and those od other studies on soil fungi in Egypt would reveal that there is no fungal flora characteristic of the Wadi soils.

RÉSUMÉ. – A partir de 100 échantillons de sol récoltés dans l'Oued de Bir-El-Ain (Égypte), 167 espèces et 10 variétés appartenant à 45 genres de champignons ont été isolés sur milieu Czapek contenant du glucose (39 et 135 espèces + 9 variétés), de la cellulose (37 genres et 113 espèces + 6 variétés), du sucrose 40 % (38 genres et 116 espèces + 6 variétés) ou du chlorure de sodium 5 % (27 genres et 99 espèces + 7 variétés).

Sur glucose et cellulose, les trois espèces les plus fréquemment isolées sont *Aspergillus niger, A. fumigatus* et *A. terreus.* Sur milieu sucrose et chlorure de Sodium, les espèces les plus fréquentes sont *Aspergillus niger, A. fumigatus, A. terreus,* le groupe *A. glaucus* (représenté par *A. chevalieri, A. amstelodami, A. ruber, A. athecius* et *A. montevidensis*) et *Penicillium chrysogenum.* Les résultats obtenus sur ces deux derniers milieux indiquent que la majorité des champignons du sol de l'Oued sont osmophiles (ou osmotolérants) et halophiles (ou halotolérants).

L'ensemble des résultats obtenus, comparés à ceux des précédentes études réalisées sur les champignons des sols d'Égypte, révèle qu'il n'existe pas de flore fongique caractéristique des sols de l'Oued.

KEY WORDS : Soil fungi, Osmophilic fungi, Halophilic fungi, Cellulose-decomposing fungi.

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Source : MNHN, Paris

I. – INTRODUCTION

Several investigations were made on Egyptian soil fungi (ABDEL-FATTAH, 1973; ABDEL-FATTAH & al., 1977; MOUBASHER & EL-DOHLOB, 1970; MOUBASHER & MOUSTAFA, 1970; MOUBASHER & ABDEL-HAFEZ, 1978a-b) but only that of ALI & al. (1975) dealt with soil fungi of one of the Wadies located in Egyptian deserts.

The present investigation aimed at an intensive study of fungi inhabiting soils of Wadi Bir-El-Ain.

Wadi Bir-El-Ain is one of the largest wadies crossing the Eastern Desert plateau to the east of Sohage. It extends in a general NE-SW direction and measures some 40 km long. It has been previously named Wadi El-Salamony by some authors, yet recently, the Wadi acquired its present name by the Egyptian Geology Survey Staff, because of the spring (or ain) located about 7 km east of the Wadi entrance.

The Wadi walls rise about 150-180 m above its floors; the floor from the mouth of the Wadi to the ain is almost barren flat, whereas the rest of it is covered by large boulders and cobbles from the surrounding rock. The width of the Wadi varies considerably from 20 to 150 m.

Wadi Bir-El-Ain, being a main channel which receives runoff water from several ravines, is subject to frequent, but unperiodic, floods from rains falling on the Red sea coastal ridges. Subsurface springs running between rock fractures and pouring in several places as well as surface water reservoirs formed in depressions are suitable shelters for growth of several hydrophytic species such as *Juncus*, *Typha* and *Phragmites*, exotic to the flora of such arid districts.

According to EL-SHARKAWI & FAYED (1975) the vegetation of the Wadi can be classified into three community types : 1. Plants of generally wide distribution and probably of moderate water requirements such as *Pulicaria undulata*, *Fagonia thebaica*, *Zilla spinosa* and *Capparis spinosa*. 2. Plants with high water requirements such as *Zygophyllum coccineum*, *Juncus arabicus*, *Typha latifolia* and *Tamarix aphylla*. Distribution of these plants is limited to places of water accumulation of crack seepage. 3. Plants with low water requirements of which are *Fagonia bruguieri*, *Moringa peregrina*, *Forskohlea tenacissima* and *Leptadenia pyrotechnica*.

II. – MATERIALS AND METHODS

100 soil samples were collected under some of the dominant plants from different places of Wadi Bir-El-Ain according to the method described by JOHNSON & al (1959).

The soil samples were analysed chemically for the estimation of total soluble salts, elements (Ca, Mg, K and Na) and organic matter. A pH-meter (WGPYE

Source : MNHN, Paris

model 290) was used for the determination of soil pH. The soil type was determined by the hydrometer method as described by PIPER (1955) and all samples are sandy.

The fungal flora of samples was determined using the dilution-plate method as described by JOHNSON & al. (1959), but with some modifications as employed by MOUBASHER & ABDEL-HAFEZ (1978 a-b). Twenty-four plates were used for each sample, six plates were poured with each of the following four isolation media; glucose- (10 g/l), cellulose- (19 g/l), 40 % sucrose- and 5 % sodium chloride-Czapek's agar. To these media rose bengal (1/15000) was added as a bacteriostatic agent (SMITH & DAWSON, 1944). Plates were incubated at 28°C for 10-15 days and the developing fungi were identified and counted and the numbers were calculated per mg dry soil.

III. – RESULTS AND DISCUSSION

Wadi Bir-El-Ain represents an interesting closed desert locality by being almost remote from the impact of man and his activities, and hence the life forms, and fungi included, are kept almost undisturbed.

The soil samples tested were generally poor in organic matter content (0.02-1.22 % of dry soil) and their contents in total soluble salts widely ranged between 0.5-4.2 %, in Ca : 0.01-4.5 mg, Mg : 0.01-0.48 mg, K : 0.04 - 2 mg, and Na : 0.04-3.5 mg/g dry soil. ABDEL-FATTAH (1973) found that the total soluble salts of Egyptian desert soils varies between 0.4 % and 6.63 %. The pH values of the soils tested were around neutrality (6.5-7.4), however, Egyptian cultivated soils previously examined were all in the alkaline side (MOUBASHER & EL-DOHLOB, 1970; MOUBASHER & MOUSTAFA, 1970; MOUBASHER & ABDEL-HAFEZ, 1978 a-b).

On glucose agar

135 species and 9 varieties which belong to 39 genera were isolated from the 100 soil samples analysed as shown in Table 1. The most frequent genera were *Aspergillus* (29 species + 5 varieties), *Penicillium* (30 species + 1 variety) and *Ulocladium* (9 species). They occurred in 99 %, 92 % and 53 % of the samples contributing 42.99 %, 43.95 % and 2.18 % of total fungi, respectively. MOUBASHER & ABDEL-HAFEZ (1978 a-b) reported that *Aspergillus*, *Penicillium* and *Fusarium* were the most common genera in Egyptian soils, but *Ulocladium* was isolated in rare frequency.

Three genera were isolated in moderate frequency and these were *Botryotrichum* (2 species), *Rhizopus* (2 species) and *Macrophomina* (1 species). They emerged from 42 %, 36 % and 30 % of the samples comprising 4.99 %, 0.32 % and 0.41 % of total fungi, respectively. These genera were recovered in low or rare frequency from cultivated desert and saline soils as reported by ABDEL-FATTAH & al. (1977), MOUBASHER & ABDEL-HAFEZ (1978 a-b). The re-

Source : MNHN, Paris

Table 1

Numbers of cases of isolation (out of 100) of fungal genera and species and their total counts (calculated per mg dry soil in every sample) on glucose-, cellulose-, 40 % sucrose- and 5 % sodium chloride- Czapek's agar at 28°C.

Tableau 1

Genres et espèces de champignons isolés sur différents milieux, à 28°C.

Genera and species	Glucose-		Cellulose-		40 % Sucrose-		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
Total count	*748.23*		*663.22*		*658.91*		*658.91*	
Aspergillus (total count)	*321.66*	99	*278.76*	97	*297.53*	100	*365.66*	99
A. niger Van Tieghem	43.22	92	29.46	83	47.8	96	44.58	91
A. fumigatus Fresenius	139.32	88	130.4	86	101.84	84	113.5	83
A. terreus Thom	72.99	58	76.84	58	56.32	57	76.36	54
A. flavus Link	4.43	37	3.44	31	3.84	34	4.43	32
A. sydowi (Bain. & Sart) Thom & Church	21.44	18	9.9	5	11.9	9	23.68	27
A. ustus (Bain.) Thom & Church	2.9	14	0.7	5	2.56	10	0.46	4
A. nidulans (Eidam) Wint.	1.56	13	0.34	5	0.88	10	1.56	13
A. carneus (V. Tiegh.) Bloch.	1.44	10	1.26	8	0.44	7	1.32	6
A. egyptiacus Moub. & Mous.	0.4	10	0.9	4	1.17	11	1.32	11
A. flavus var. *columnaris* Raper & Fennell	1.41	9	1.24	14	2.18	14	2.8	11
A. terreus var. *africanus* Fennell & Raper	6.4	9	7.96	2	2.16	7	6.94	3
A. candidus Link	0.42	8	0.14	3	0.04	1	0.22	4
A. nidulans var. *latus* Thom & Raper	9.08	8	7.74	6	9.26	7	11.08	8
A. ochraceus Wilhelm	1.56	7	1.12	6	3.57	12	0.42	7
A. quadrilineatus Thom & Raper	1.1	7	2.32	7	2.64	7	5.02	6
A. chevalieri (Mangin) Thom & Church	2	4	0.16	3	6.38	20	5.62	21
A. ruber (Konig, Spieckermann & Bremer) Thom & Church	0.46	4	0.04	[illegible]	1.8	3	2.98	7
Aspergillus sp.	0.44	3			3.36	4	0.08	1
A. niveus Blochwitz	0.18	3	0.07	2				
A. sulphureus (Fres.) Thom & Church	2.16	3	1.42	3	2.36	5	2.16	5
A. amstelodami (Mangin) Thom & Church	0.68	2	0.16	3	32.34	15	55.24	25
A. mellus Yukawa	0.12	2	0.04	1	0.04	1	0.12	2
A. nidulans var. *acristatus* Fennell & Raper	0.1	2	0.06	[illegible]			0.18	1
A. rugulosus Thom & Raper	1.56	2	0.04	1	0.36	2	1.48	2

Source : MNHN, Paris

Genera and species	Glucose		Cellulose		40 % Sucrose		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
A. terricola Marchal	0.14	2					0.4	2
A. versicolor (Vuill.) Tirab.	2.4	2	2.24	4	3.32	11	2.14	16
A. wentii Wehmer	0.59	2	0.58	2	0.18	1	0.4	2
A. avenaceus Smith	0.08	1						
A. fischeri Wehmer	0.04	1	0.04	1	0.08	2		
A. flavipes (Bain. & Sart.) Thom & Church	0.04	1					0.08	1
A. flavo-furcatis Bat. & Maia	0.08	1						
A. fumigatus var. *albus* Rai, Tewari & Agrawal	0.12	1	0.04	1	0.04	1	0.04	1
A. tamarii Kita	0.08	1			0.06	1	0.08	1
A. terreus var. *aureus* Thom & Raper	0.04	1						
A. variecolor (Berk. & Bro.) Thom & Raper	0.04	1						
A. violaceus Fennell & Raper	0.08	1	0.08	2	0.18	3	0.22	4
A. clavatus Desmazières			0.06	1				
A. parasiticus Speare			0.04	1	0.1	2	0.12	2
A. janus Raper & Thom					0.12	3		
A. nidulans var. *dentatus* Sandhue & Sandhue					0.14	3	0.04	1
A. athecius Raper & Fennell							0.18	2
A. montevidensis Talica & Mack.							0.06	1
Penicillium (total count)	*328.82*	92	*297.44*	79	*289.52*	91	*312.52*	94
P. chrysogenum Thom	151.74	65	110.54	38	114.6	70	15.74	62
P. citrinum Thom	128.41	39	145.42	25	142.47	36	159.8	49
P. corylophilum Dierckx	2.17	27	5.2	22	7.37	34	2.04	25
P. oxalicum Currie & Thom	21.1	11	21.96	4	4.36	9	14.06	12
P. funiculosum Thom	2	9	1.12	8	0.26	4	0.04	1
P. lanosum Westling	3.04	7	0.22	2	12.4	5	6.62	6
P. jenseni Zaleski	0.67	6	2.4	3	1.84	10	1.09	9
P. verruculosum Peyronel	1.28	4	0.28	2	0.56	2	0.04	1
P. brevi-compactum Dierckx	3.06	3	6.88	2	2.02	3	1.18	5
P. purpurogenum Stoll	0.24	3			0.2	3	0.04	1
P. rugulosum Thom	0.76	3			0.24	1	0.24	3
P. stoloniferum Thom	0.62	3	0.08	1	0.08	1	1.08	3
P. roqueforti Thom	2.7	2			0.96	1		
P. asperum Shear	0.04	1			0.04	1		

Source : MNHN, Paris

Genera and species	Glucose-		Cellulose-		40 % Sucrose-		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
P. cyclopium Westling	0.12	1			0.16	2		
P. cyclopium var. *echinulatum* Westling	0.04	1			0.04	1	1.12	1
P. duclauxi Delacroix	0.1	1	0.04	1	0.1	1		
P. janthinellum Biourge	0.06	1						
P. kapuscinskii Zaleski	8.4	1	0.8	1			1.84	2
P. martensii Biourge	0.06	1					0.28	1
P. megasporum Orpurt & Fennell	0.76	1						
P. nigricans (Bain.) Thom	0.8	1	0.04	1	1.52	1		
P. puberulum Bainier	0.12	1					0.28	1
P. rubrum Stoll	0.08	1	0.04	1	0.08	1		
P. simplicissimum (Oud.) Thom	0.28	1						
P. steckii Zaleski	0.04	1					1.58	2
P. velutinum Van Beyma	0.04	1						
P. vinaceum Gilman & Abbott	0.04	1						
P. viridicatum Westling	0.04	1	1.64	1	0.16	2	6.04	2
P. waksmani Zaleski	0.06	1			0.06	1	1.04	3
P. albidum Sopp			0.04	1			0.01	2
P. humili Van Beyma			0.04	1				
P. piscarium Westling			0.24	1				
P. daleae Zaleski							0.06	1
P. spinulosum Thom							0.28	1
Ulocladium (total count)	*16.33*	53	*9.9*	38	*18.04*	50	*20.17*	52
U. botrytis Preuss	11.5	28	6.44	29	10.2	38	9.78	38
U. atrum Preuss	2.28	17	1.9	16	2.78	16	3.94	20
U. consortiale (Tum) Simmons	0.28	4	0.16	3	0.45	3	0.28	4
U. chartarum (Preuss) Simmons	0.6	3	0.12	2	0.92	3	1.88	2
U. chlamydospora Mouchacca	1.2	3	0.28	2	1.5	4	3.4	5
U. tuberculatum Simmons	0.22	3	0.08	1	0.56	1	0.58	4
U. alternaria (Cke) Simmons	0.08	2	0.34	3	1.51	4	0.08	2
U. septosporum (Pr.) Simmons	0.13	2	0.08	1	0.04	1	0.17	2
U. microsporum Moubasher & Abdel-Hafez	0.04	1			0.04	1		
U. lanuginosum (Harz) Simmons					0.04	1		
U. oudemansii Simmons					0.06	1	0.06	1

Source : MNHN, Paris

Genera and species	[illegible]		[illegible]		[illegible] sucrose		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
Botryotrichum (total count)	*37.34*	42	*29.34*	38	*27.22*	36	*12.26*	15
B. atrogriseum Van Beyma	21.99	30	11.02	29	13.38	24	5.34	12
B. piluliferum Saccardo & March.	15.35	25	18.32	22	13.84	24	6.92	8
Rhizopus (total count)	*2.4*	36	*1.6*	22	*2.01*	27	*0.36*	8
R. stolonifer Ehrenb. ex Fr. Lindt	1.92	29	1.28	17	1.53	21	0.28	6
R. oryzae Went & Prinsen Geerlings	0.48	10	0.32	5	0.48	6	0.08	2
Macrophomina phaseoli (Maubl.) Ashby	3.08	30	4.3	40	2.14	19	0.36	5
Fusarium (total count)	*4.88*	23	*7.28*	21	*1.78*	18	*1.4*	14
F. oxysporum Schlecht ex Fr.	1.08	10	2.72	8	0.58	5	0.34	4
F. solani (Mart.) Sacc.	2.56	8	3.04	11	0.32	5	0.44	4
F. moniliforme Sheldon	0.66	5	1.04	4			0.32	2
F. equiseti (Corda) Sacc.	0.04	1	0.28	3	0.32	1		
F. semitectum Berk. & Rav.	0.06	1						
F. tricinctum (Corda) Sacc.	0.04	1	0.04	1	0.16	2		
F. culmorum (Smith) Sacc.							0.04	1
Fusarium sp.	0.44	1	0.16	2	0.4	5	0.26	4
Cladosporium (total count)	*6.08*	21	*2.9*	20	*6.83*	44	*2.82*	27
C. herbarum (Pers.) Link ex Fr.	0.7	11	0.86	13	2.82	31	2.16	20
C. cladosporioides (Fres.) de Vries	0.6	10	0.8	6	1.9	21	0.46	7
C. macrocarpum Preuss	0.32	4			0.38	7	0.04	1
C. sphaerospermum Penzig	4.46	4	1.24	8	1.28	19	0.16	2
Stachybotrys (total count)	*6.84*	21	*7.66*	31	*1.46*	7	*0.06*	1
S. chartarum (Ehrenb ex Link) Hughes	5.7	18	6.84	28	0.94	4	0.06	1
S. bisybi (Srin) Barron	0.72	3	0.12	1	0.44	1		
S. microspora (Mathur & Sankhla) Jong & Davis	0.42	2	0.66	5	0.04	1		
Stachybotrys sp.			0.04	1	0.04	1		
Trimmatostroma (total count)	*2.97*	20	*3.7*	31	*1.69*	17	*0.1*	2
T. betulinum (Corda) Hughes	2.33	15	3.22	28	1.13	14	0.06	1
T. salicis Corda	0.64	8	0.48	7	0.56	4	0.04	1
Alternaria (total count)	*1.14*	15	*1.68*	22	*1.57*	21	*1.36*	22
A. alternata (Fries) Keissler	0.67	12	1.64	22	1.39	17	0.84	17
A. chlamydospora Mouchacca	0.32	3	0.04	1	0.08	2	0.4	4
A. raphani Groves & Skolko	0.06	1					0.04	1

Source : MNHN, Paris

Genera and species	Glucose-		Cellulose-		40 % Sucrose-		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
A. tenuissima (Kunze ex Pers.) Wiltshire					0.1	1	0.08	2
Humicola (total count)	*2.5*	13	*0.86*	7	*0.44*	4	*0.2*	3
H. grisea Traaen	1.62	9	0.78	5	0.2	3	0.2	3
H. fuscoatra Traaen	0.76	3	0.04	1	0.24	1		
H. fuscoatra var. *longispora* Fassatiova	0.12	2	0.04	1				
Mucor (total count)	*1.94*	12	*0.36*	6	*1.03*	10	*0.6*	4
M. hiemalis Wehmer	0.62	9	0.2	3	0.65	7	0.08	2
M. racemosus Fresenius	0.92	2	0.04	1	0.3	1	0.48	1
M. subtilissimus Oudemans	0.04	1	0.08	2	0.04	1		
M. racemosus var. *sphaerospora* (Hagam) Schipper	0.32	1						
M. globosus Fischer					0.04	1	0.04	1
Mucor species	0.04	1	0.04	1				
Papulaspora sepedonioides Preuss	0.87	11	2.34	16	1.28	9	0.56	4
Phoma humicola Gilman & Abbott	0.7	11	0.68	5	0.32	4	0.16	2
Monodictys (total count)	*0.98*	10	*0.48*	6	*0.36*	5	*1.36*	5
M. putridinis (Wallr.) Hughes	0.36	4	0.36	4	0.28	3	0.92	3
M. castaneae (Wallr.) Hughes	0.38	3	0.04	1	0.04	1	0.04	1
M. antique (Corda) Hughes	0.12	1						
M. asperospora (Cooke & Massee) Ellis	0.04	1						
M. levis (Wiltshire) Hughes	0.08	1	0.08	1				
M. glauca (Cooke & Harkn.) Hughes					0.04	1		
M. fluctuata (Tandon & Bilg.) Ellis					0.04	1	0.04	1
Chaetomium (total count)	*2.1*	9	*4.26*	27	*0.08*	2	*0.12*	1
C. globosum Kunze ex Fries	1.44	5	0.72	10	0.04	1	0.12	1
C. jodhpurence Lodha	0.28	4						
C. olivaceum Cooke & Ellis	0.38	3	1.78	15	0.04	1		
C. spirale Zopf			1.6	4				
C. bostrychodes Zopf			0.08	2				
C. perlucidum Sergejeva			0.04	1				
Chaetomium species			0.04	1				
Drechslera (total count)	*0.52*	8	*0.62*	11	*0.66*	8	*0.08*	2
D. spicifer Nelson	0.26	4	0.44	8	0.28	3	0.04	1

Source : MNHN, Paris

Genera and species	Glucose-		Cellulose-		40 % Sucrose-		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
D. halodes (Drec.) Subram. & Jain	0.16	2	0.1	2	0.3	3		
D. australiensis (Bug.) Subram. & Jain	0.06	1			0.04	1	0.04	1
D. hawaiiensis (Bug.) Subram. & Jain	0.04	1						
D. rostrata (Drec.) Rich. & Fraser			0.04	1				
D. sativus (Ito & Kur.) Drec. ex Daster			0.04	1				
D. papendorfi Van der Aa					0.04	1		
Torula (total count)	*0.88*	6	*1.04*	5	*0.1*	1	*0.14*	3
T. graminis Besm.	0.06	3	0.36	1			0.06	1
T. herbarum (Pers.) Link ex Gray	0.28	3	0.68	5	0.1	1	0.08	2
Cunninghamella (total count)	*0.22*	5	*0.08*	2	*0.1*	2		
C. echinulata (Thaxt.) Thaxt. ex Blakeslea	0.14	3	0.08	2	0.1	2		
C. elegans Lendner	0.08	2						
Paecilomyces varioti Bainier	0.36	5	0.68	7	0.74	8	0.16	4
Stemphylium botryosum Wallroth	0.76	4	0.44	5	0.67	5		
Trichoderma viride Pers. ex Gray	0.19	4	0.24	2	0.14	3		
Acremonium strictum Gams	0.16	3	0.08	1	0.36	2	0.04	1
Epicoccum purpurascens Ehrenb. ex Schlecht	0.8	3	0.36	2	0.43	6		
Hormiscium stilbosporum (Corda) Saccardo	0.18	3			0.08	1	0.06	1
Microascus cinerus (Emile-Weil et Gaudin) Curzi	0.28	3	0.36	4	0.16	2	0.24	2
Scopulariopsis (total count)	*0.18*	3	*1.04*	5	*0.1*	2	*0.4*	1
S. brevicaulis (Sacc.) Bainier	0.08	1	0.34	2	0.06	1	0.4	1
S. candida (Gueg.) Vuillemin	0.04	1						
S. croci Van Beyma	0.06	1						
S. brumptii Salvanet-Duval			0.58	2	0.04	1		
S. chartarum Smith			0.12	2				
Sepedonium chrysospermum (Bull.) Fries	0.26	3			0.12	2		
Circinella simplex Van Tieghem	0.08	2					0.04	1
Curvularia (total count)	*0.12*	2	*0.5*	8	*0.12*	1		
C. clavata Jain	0.06	1						
C. lunata (Walker) Boedijn	0.06	1	0.32	5	0.12	1		
C. pallescens Boedijn			0.18	3				
Myrothecium (total count)	*0.62*	2	*0.44*	6				

Source : MNHN, Paris

Genera and species	Glucose-		Cellulose-		40 % Sucrose-		5% Sodium chloride	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI
M. roridum Tode	0.32	1	0.4	5				
M. verrucaria (Alb. & Sch.) Dit.	0.3	1	0.4	1				
Acrophialophora fusispora Saksena	0.12	1	0.08	2	0.06	1		
Diplococcium species	0.04	1			0.06	1		
Gliocladium catenulatum Gilman & Abbott	0.06	1	0.06	1	0.12	2	0.06	1
Scolecobasidium variabile Barron & Busch	0.04	1	0.08	1	0.2	1	1.64	2
Syncephalastrum racemosum (Cohn) Schroeter	0.18	1	0.08	1				
Thielavia sepedonium Emmons	0.06	1	0.08	2				
Trichothecium roseum (Pers.) Link ex Fr.	0.06	1						
Arthrobotrys oligospora Corda			1.26	4				
Cephaliophora tropica Thaxter			0.08	1				
Nigrospora oryzae Hudson			0.08	1	0.08	1		
Neurospora crassa Shear & Dodge					0.14	2		
Coniothyrium fuckelli Saccardo					0.06	1		
Rhizoctonia solani Kuhn					0.04	1		
Mycelia sterilia (white and dark colour)	1.38	16	2	8	1.52	15	0.87	11

TC : total count per mg dry soil in every samples.
NCI : number of cases of isolation (out of 100 samples).

High occurrence : more than 49 cases.
Moderate occurrence : between 25 - 49 cases.
Low occurrence : between 13 - 24 cases.
Rare occurrence : less than 13 cases.

Source : MNHN, Paris

maining thirty-three genera recorded were isolated in low or rare frequency (Table 1).

From the preceding genera four species were isolated in high frequency; these were *A. niger, A. fumigatus, A. terreus* and *P. chrysogenum*. They emerged from 58-92 % of the samples constituting 5.78 - 20.28 % of total fungi. These four species were also common in Egyptian cultivated (MOUBASHER & ABDEL-HAFEZ, 1978 a - b), desert and saline soils (ABDEL-FATTAH, 1973; ABDEL-FATTAH & al., 1977), under *Citrus* trees and on the surfaces of *Citrus* fruits and leaves (MOUBASHER & al., 1971), on leaves of some Egyptian summer and winter plants (ABDEL-GAWAD, 1978, 1984) and on seeds and grains (MOUBASHER & al., 1972; MOUBASHER & al., 1979 b; ABDEL-KADER & al., 1979).

Eight species were isolated in moderate frequency and these were *P. citrinum, A. flavus, B. atrogriseum, M. phaseoli, R. stolonifer, U. botrytis, P. corylophilum* and *B. piluliferum*. They occurred in 25-41 % of the samples constituting 0.29-17.61 % of total fungi. These eight species were also reported from Egyptian soils (MOUBASHER & ABDEL-HAFEZ, 1978 a-b). The remaining isolated species were recovered in low or rare frequency as presented in Table 1.

On cellulose agar

113 species and 6 varieties representing 37 genera were collected, which means a narrower spectrum of genera and species than on glucose agar and this is reasonable since glucose is a more easily utilizable carbohydrate by fungi.

The results obtained on cellulose plates were basically similar to those on glucose with the most frequent genera being *Aspergillus* (24 species + 4 varieties) and *Penicillium* (19 species) followed but far behind by *Macrophomina* (1 species), *Botryotrichum* (2 species), *Ulocladium* (8 species), *Stachybotrys* (3 species), *Trimmatostroma* (1 species) and *Chaetomium* (5 species). They emerged from 27-97 % of the samples contributing 0.6-44.85 % of total fungi.

The remaining twenty-seven genera were isolated in low or rare frequency (Table 1). These genera contributed three species in high frequency : *A. fumigatus, A. niger* and *A. terreus*, which were also the commonest ones on glucose agar. They were encountered in 86 %, 83 % and 58 % of the samples contributing 19.66 %, 4.44 % and 11.59 % of total fungi, respectively. These three species were also prevalent in cellulose plates from Egyptian soils (ABDEL-HAFEZ & al., 1978) and barley grains (ABDEL-HAFEZ & ABDEL-KADER, 1980).

The frequency of several fungi was however promoted on cellulose than on glucose Czapek's agar; example *S. chartarum* (from 18 to 28 samples), *M. phaseoli* (30 to 40), *C. globosum* (5 to 10), *C. olivaceum* (3 to 15), *A. alternata* (12 to 22) and *D. spicifera* (4 to 8). On the contrary, the frequency of others was depressed; example *A. nidulans* (13 to 5), *A. ustus* (14 to 5), *A. sydowi* (18 to 5), *P. citrinum* (39 to 25), *P. chrysogenum* (31 to 11) and *R. stolonifer* (29 to 17). This is almost in agreement with the results obtained by ABDEL-HAFEZ & al. (1978) and ABDEL-HAFEZ & ABDEL-KADER (1980). Most of

Source : MNHN, Paris

the fungal species recovered on cellulose agar were reported to be cellulose-decomposing (FLANNIGAN, 1970; MALIK & EGGINS, 1970; MAZEN, 1973; PUGH & al., 1963; STEWART & WALSH, 1972; TRIBE, 1957, 1961, 1966).

On 40 % sucrose agar

116 osmophilic (or osmotolerant) species and 6 varieties belonging to 38 genera were identified (compare with 39 genera and 135 species + 9 varieties on 1 % glucose agar). The majority of these osmophiles have been previously isolated in this laboratory on 30 - 60 % sucrose from Egyptian soils (ABDEL-HAFEZ & al., 1977), barley grains (MOUBASHER & al., 1979 a) and soils of some Arab countries (ABDEL-HAFEZ, 1982 a - b; ABDEL-HAFEZ & al:, 1983; MOUBASHER & al., 1981; MOUSTAFA, 1975; MOUSTAFA & AL-MUSALLAM, 1975).

The most frequent genera encountered were *Aspergillus*, *Penicillium* and *Ulocladium*; these emerged in 100 %, 91 % and 50 % of the samples constituting 45.15 %, 43.94 % and 2.74 % of total fungi respectively. The highest count and frequency of occurrence were displayed by *A. niger*, *A. fumigatus*, *A. terreus*, *A. glaucus* group (represented by *A. chevalieri*, *A. amstelodami* and *A. ruber*), *A. flavus*, *P. chrysogenum*, *P. citrinum*, *P. corylophilum*, *U. botrytis* and *C. herbarum*. They were encountered in 31 - 96 % of the samples contributing 0.43 - 21.62 % of total fungi. The most interesting species were *A. chevalieri* and *A. amstelodami* which were isolated from 4 and 2 samples on 1 % glucose agar, their frequencies were promoted respectively to 20 and 15 samples on 40 % sucrose agar. RAPER & FENNELL (1965), in their treatise on the genus *Aspergillus*, reported that the *A. glaucus* group (to which belong *A. chevalieri* and *A. amstelodami*) and most species of the *A. restrictus* group are osmophilic fungi. MOUSTAFA & EL-MUSALLAM (1975) reported that *A. amstelodami* was highly osmophilic (best growth at 60 % sucrose agar). ABDEL-HAFEZ & al. (1977) and MOUBASHER & al. (1979 a) found that these two species were of high or moderate frequency of occurrence in Egyptian salt marsh soils and grains on 30 or 60 % sucrose agar. Also, MOUBASHER & al. (1981) reported *Aspergillus niger*, *A. amstelodami*, *A. flavus*, *A. repens*, *A. restrictus*, *Penicillium notatum* and *Rhizopus stolonifer* on 40 % sucrose agar from Jordanian soils.

On 5 % sodium chloride

99 halophilic (or halotolerant) species and 7 varieties which belong to 28 genera were collected from the soils tested. Most of them were previously isolated on normal Czapek's agar from Egyptian soil, air, seeds and grains as reported by ABDEL-GAWAD (1978, 1984), MOUBASHER & EL-DOHLOB (1970), MOUBASHER & MOUSTAFA (1970), MOUBASHER & ABDEL-HAFEZ (1978 a - b), MOUBASHER & al. (1971, 1972, 1979 b).

The most frequent halophilic (or halotolerant) species were *Aspergillus niger*, *A. fumigatus*, *A. glaucus* group (represented by *A. amstelodami*, *A. chevalieri*, *A. ruber*, *A. athecius* and *A. montevidensis*), *A. terreus*, *A. sydowi*, *Penicillium*

Source : MNHN, Paris

chrysogenum, *P. citrinum*, *P. corylophilum* and *Ulocladium botrytis*; these fungi emerged from 25 - 91 % of the samples contributing 0.28 - 22.03 % of total fungi. The great majority of the species recovered on 5 % sodium chloride agar were also encountered from 120 soil samples collected from Red Sea Shore by ABOL-NASER (1981); in these samples, the most frequent fungi were *Aspergillus niger*, *A. fumigatus*, *A. sydowi*, *A. flavus*, *A. terreus*, *A. glaucus* group (represented by *A. amstelodami* and *A. chevalieri*), *A. ochraceus* and *Penicillium notatum*. Also ABDEL-HAFEZ (1981) isolated 67 halophilic species from 40 soil samples collected from desert areas in Saudi Arabia; he found that *A. chevalieri*, *A. ruber*, *P. brevi-compactum*, *U. consortiale*, *S. brevicaulis* and *B. piluliferum* were the most prevalent.

In conclusion, the present results reveal that *Aspergillus*, *Penicillium* and *Ulocladium* were consistently the most frequent genera on the four isolation media. But *Fusarium*, which is the third most common fungus in cultivated soils as reported by MOUBASHER & ABDEL-HAFEZ (1978 a - b), retreated to a backward situation in the Wadi soils. Also, *Ulocladium*, *Macrophomina* and *Botryotrichum* gained a better position than in cultivated soils.

Also, the great majority of fungal species recovered from the Wadi soils are osmophilic (or osmotolerant) and halophilic (or halotolerant), a property which would qualify them to encounter the dry conditions of the Wadi.

Comparison between the lists of fungi recovered from desert soils in Egypt (ABDEL-FATTAH, 1973), Kuwait (MOUSTAFA & AL-MUSALLAM, 1975), Saudi Arabia (ABDEL-HAFEZ, 1982 a - b) and Sonoran, U.S.A. (RANZONI, 1968) reveal that there is no fungal flora characteristic of Wadi Bir-El-Ain soils. These lists may differ in the order of frequency of the component fungi.

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Source : MNHN, Paris

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